SEQUENCE LISTING

<110> Johal, Gurmukh S
     Multani, Dilbag S

<120> ISOLATED NUCLEIC ACID MOLECULES ENCODING THE DW3
     P-GLYCOPROTEIN OF SORGHUM AND METHODS OF MODIFYING
     GROWTH IN TRANSGENIC PLANTS THEREWITH

<130> 035718/275581

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<150> 60/165,176
<151> 1999-11-12

<150> 09/711,619
<151> 2000-11-13

<160> 9

<170> PatentIn Ver. 2.1

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Leu Leu Ala Val Phe Pro Leu Val Val Gly Ala Thr Val Leu Gln Lys
  1               5                  10                  15


atg ttc atg aag ggc ttc tcg ggg gac ctg gag gcc gcg cac gcc agg     96
Met Phe Met Lys Gly Phe Ser Gly Asp Leu Glu Ala Ala His Ala Arg
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                20                      25                        30

gcc acg cag atc gcg ggc gag gcc gtg gcc aac ctg cgc acc gtg gcc    144
Ala Thr Gln Ile Ala Gly Glu Ala Val Ala Asn Leu Arg Thr Val Ala
         35                  40                  45

gcg ttc aac gcg gag cgc aag atc acg ggg ctg ttc gag gcc aac ctg    192
Ala Phe Asn Ala Glu Arg Lys Ile Thr Gly Leu Phe Glu Ala Asn Leu
     50                  55                  60

cgc ggc ccg ctc cgg cgc tgc ttc tgg aag ggg cag atc gcc ggc agc    240
Arg Gly Pro Leu Arg Arg Cys Phe Trp Lys Gly Gln Ile Ala Gly Ser
 65                  70                  75                  80

ggc tac ggc gtg gcg cag ttc ctg ctg tac gcg tcc tac gcg ctg ggg    288
Gly Tyr Gly Val Ala Gln Phe Leu Leu Tyr Ala Ser Tyr Ala Leu Gly
             85                  90               .  95

ctg tgg tac gcg gcg tgg ctg gtg aag cac ggc gtg tcc gac ttc tcg    336
Leu Trp Tyr Ala Ala Trp Leu Val Lys His Gly Val Ser Asp Phe Ser
            100                 105                 110

cgc acc atc cgc gtg ttc atg gtg ctg atg gtg tcc gcc aac ggc gcc    384
Arg Thr Ile Arg Val Phe Met Val Leu Met Val Ser Ala Asn Gly Ala
            115                 120                 125

gcc gag acg ctg acg ctg gcg ccg gac ttt gtc aag ggc ggg cgc gcg    432
Ala Glu Thr Leu Thr Leu Ala Pro Asp Phe Val Lys Gly Gly Arg Ala
        130                 135                 140

atg cgg tcc gtg ttc gag acc atc gac cgg aaa acg gag gtg gag ccc    480
Met Arg Ser Val Phe Glu Thr Ile Asp Arg Lys Thr Glu Val Glu Pro
145                 150                 155                 160

gac gac gtg gac gcg gcg ccg gtg ccg gag cgg ccc aag ggc gag gtg    528
Asp Asp Val Asp Ala Ala Pro Val Pro Glu Arg Pro Lys Gly Glu Val
             165                 170                 175

gag ctg aag cac gtg gac ttc tcg tac ccg tcg cgg ccg gac atc cag    576
Glu Leu Lys His Val Asp Phe Ser Tyr Pro Ser Arg Pro Asp Ile Gln
            180                 185                 190

gtg ttc cgc gac ctg agc ctc cgg gcg cgc gcc ggg aag acg ctg gcg    624
Val Phe Arg Asp Leu Ser Leu Arg Ala Arg Ala Gly Lys Thr Leu Ala
            195                 200                 205

ctg gtg ggt ccg agc ggg tgc ggc aag agc tcg gtg ctg gcg ctg gtg    672
Leu Val Gly Pro Ser Gly Cys Gly Lys Ser Ser Val Leu Ala Leu Val
         210                 215                 220

cag cgg ttc tac gag ccc acg tcc ggg cgc gtg ctc ctg gac ggc aag    720
Gln Arg Phe Tyr Glu Pro Thr Ser Gly Arg Val Leu Leu Asp Gly Lys  .
225                 230                 235                 240

gac gtg cgc aag tac aac ctg cgg gcg ctg cgg cgc gtg gtg gcg gtg    768
Asp Val Arg Lys Tyr Asn Leu Arg Ala Leu Arg Arg Val Val Ala Val
             245                 250                 255
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gcg ccg cag gag ccg ttc ctg ttc gcg gcg agc atc cac gac aac atc      816
Ala Pro Gln Glu Pro Phe Leu Phe Ala Ala Ser Ile His Asp Asn Ile
            260                 265                 270

gcg tac ggg cgc gag ggc gcg acg gag gcg gag gtg gtg gag gcg gcg      864
Ala Tyr Gly Arg Glu Gly Ala Thr Glu Ala Glu Val Val Glu Ala Ala
            275                 280                 285

acg cag gcg aac gcg cac cgg ttc atc gcg gcg ctg ccg gag ggc tac      912
Thr Gln Ala Asn Ala His Arg Phe Ile Ala Ala Leu Pro Glu Gly Tyr
        290                 295                 300

ggg acg cag gtg ggc gag cgc ggg gtg cag ctg tcg ggc ggg cag cgg      960
Gly Thr Gln Val Gly Glu Arg Gly Val Gln Leu Ser Gly Gly Gln Arg
305                 310                 315                 320

cag cgg atc gcg atc gcg cgc gct ggt aag cag cgg cca tcg tgc tgc     1008
Gln Arg Ile Ala Ile Ala Arg Ala Gly Lys Gln Arg Pro Ser Cys Cys
                325                 330                 335

tgg acg agg cga cca gcg cgc tgg acg ccg agt cgg agc ggt gcg tgc     1056
Trp Thr Arg Arg Pro Ala Arg Trp Thr Pro Ser Arg Ser Gly Ala Cys
            340                 345                 350

agg agg cgc tgg agc gcg cgg ggt ccg ggc gca cca cca tcg tgg tgg     1104
Arg Arg Arg Trp Ser Ala Arg Gly Pro Gly Ala Pro Pro Ser Trp Trp
            355                 360                 365

cgc acc ggc tgg cca cgg tgc gcg gcg cgc aca cca tcg cgg tca tcg     1152
Arg Thr Gly Trp Pro Arg Cys Ala Ala Arg Thr Pro Ser Arg Ser Ser
        370                 375                 380

acg acg gca agg tgg cgg agc agg ggt cgc act cgc acc tgc tca agc     1200
Thr Thr Ala Arg Trp Arg Ser Arg Gly Arg Thr Arg Thr Cys Ser Ser
385                 390                 395                 400

acc atc ccg acg ggt gct acg cgc gga tgc tgc agc tgc agc ggc         1245
Thr Ile Pro Thr Gly Ala Thr Arg Gly Cys Cys Ser Cys Ser Gly
                405                 410                 415

tgacgggcgc ggcggc                                                   1261


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<211> 415
<212> PRT
<213> Sorghum bicolor

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Leu Leu Ala Val Phe Pro Leu Val Val Gly Ala Thr Val Leu Gln Lys
 1               5                  10                  15

Met Phe Met Lys Gly Phe Ser Gly Asp Leu Glu Ala Ala His Ala Arg
            20                  25                  30

Ala Thr Gln Ile Ala Gly Glu Ala Val Ala Asn Leu Arg Thr Val Ala
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Ala Phe Asn Ala Glu Arg Lys Ile Thr Gly Leu Phe Glu Ala Asn Leu
    50                      55                      60

Arg Gly Pro Leu Arg Arg Cys Phe Trp Lys Gly Gln Ile Ala Gly Ser
    65                      70                      75                  80

Gly Tyr Gly Val Ala Gln Phe Leu Leu Tyr Ala Ser Tyr Ala Leu Gly
                    85                      90                      95

Leu Trp Tyr Ala Ala Trp Leu Val Lys His Gly Val Ser Asp Phe Ser
                    100                     105                     110

Arg Thr Ile Arg Val Phe Met Val Leu Met Val Ser Ala Asn Gly Ala
                115                     120                     125

Ala Glu Thr Leu Thr Leu Ala Pro Asp Phe Val Lys Gly Gly Arg Ala
    130                     135                     140

Met Arg Ser Val Phe Glu Thr Ile Asp Arg Lys Thr Glu Val Glu Pro
145                     150                     155                     160

Asp Asp Val Asp Ala Ala Pro Val Pro Glu Arg Pro Lys Gly Glu Val
                165                     170                     175

Glu Leu Lys His Val Asp Phe Ser Tyr Pro Ser Arg Pro Asp Ile Gln
                180                     185                     190

Val Phe Arg Asp Leu Ser Leu Arg Ala Arg Ala Gly Lys Thr Leu Ala
                195                     200                     205

Leu Val Gly Pro Ser Gly Cys Gly Lys Ser Ser Val Leu Ala Leu Val
    210                     215                     220

Gln Arg Phe Tyr Glu Pro Thr Ser Gly Arg Val Leu Leu Asp Gly Lys
225                     230                     235                     240

Asp Val Arg Lys Tyr Asn Leu Arg Ala Leu Arg Arg Val Val Ala Val
                245                     250                     255

Ala Pro Gln Glu Pro Phe Leu Phe Ala Ala Ser Ile His Asp Asn Ile
                260                     265                     270

Ala Tyr Gly Arg Glu Gly Ala Thr Glu Ala Glu Val Val Glu Ala Ala
                275                     280                     285

Thr Gln Ala Asn Ala His Arg Phe Ile Ala Ala Leu Pro Glu Gly Tyr
    290                     295                     300

Gly Thr Gln Val Gly Glu Arg Gly Val Gln Leu Ser Gly Gly Gln Arg
305                     310                     315                     320

Gln Arg Ile Ala Ile Ala Arg Ala Gly Lys Gln Arg Pro Ser Cys Cys
                325                     330                     335

Trp Thr Arg Arg Pro Ala Arg Trp Thr Pro Ser Arg Ser Gly Ala Cys
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        340                     345                     350

Arg Arg Arg Trp Ser Ala Arg Gly Pro Gly Ala Pro Pro Ser Trp Trp
    355                 360                 365

Arg Thr Gly Trp Pro Arg Cys Ala Ala Arg Thr Pro Ser Arg Ser Ser
    370                 375                 380

Thr Thr Ala Arg Trp Arg Ser Arg Gly Arg Thr Arg Thr Cys Ser Ser
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Thr Ile Pro Thr Gly Ala Thr Arg Gly Cys Cys Ser Cys Ser Gly
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<212> DNA
<213> Artificial Sequence

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<223> Description of Artificial Sequence:oligonucleotide
      primer designed from sequence of Zea mays Br2 gene

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<212> DNA
<213> Artificial Sequence

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Gly Ala Pro His Ala Asp Asp Asp Ala Gly Asp Glu Trp Ala Arg Pro
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gag ctc gag gcc ttc cac ctc ccc tct ccc gcc cac cag cct cct ggc     144
Glu Leu Glu Ala Phe His Leu Pro Ser Pro Ala His Gln Pro Pro Gly
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ttc cac cta gcc gct ggg cac caa ccg gaa gct gca gca gag caa ccc     192
Phe His Leu Ala Ala Gly His Gln Pro Glu Ala Ala Ala Glu Gln Pro
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acc acg ctc cct gct gcc cgc cgc acc agc gac aca tcc act gct gct     240
Thr Thr Leu Pro Ala Ala Arg Arg Thr Ser Asp Thr Ser Thr Ala Ala
 65              70                  75                  80

ggt gct gct cct cct tct cct tcg ccg cct ccg ccg ccg gct cct ttg     288
Gly Ala Ala Pro Pro Ser Pro Ser Pro Pro Pro Pro Ala Pro Leu
                85                  90                  95

gag atg gac cag ccg ccc aat gcc aag ccg gcc tcc tcc tcc gcc gcc     336
Glu Met Asp Gln Pro Pro Asn Ala Lys Pro Ala Ser Ser Ser Ala Ala
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gcc gcc ggc gcc aat gac aac aag aag ccc acc ccg ccc gcc gcg ctg     384
Ala Ala Gly Ala Asn Asp Asn Lys Lys Pro Thr Pro Pro Ala Ala Leu
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cgc gac ctc ttc cgc ttc gcc gac ggc ctc gac tgc gcg ctc atg ctc     432
Arg Asp Leu Phe Arg Phe Ala Asp Gly Leu Asp Cys Ala Leu Met Leu
        130                 135                 140

gtc ggc acg ctc ggc gcg ctc gtc cac ggc tgc tcg ctc ccc gtc ttc     480
Val Gly Thr Leu Gly Ala Leu Val His Gly Cys Ser Leu Pro Val Phe
145                 150                 155                 160

ctc cgc ttc ttc gcc gac ctc gtc gac tcc ttc ggc tcc cac gcc aac     528
Leu Arg Phe Phe Ala Asp Leu Val Asp Ser Phe Gly Ser His Ala Asn
                165                 170                 175

gac ccg gac acc atg gtc cgc ctc gtc gtc aag tac gcc ttc tac ttc     576
Asp Pro Asp Thr Met Val Arg Leu Val Val Lys Tyr Ala Phe Tyr Phe
                180                 185                 190

ctc gtc gtc gga gcc gca atc tgg gcg tcc tca tgg gca gag atc tcc     624
Leu Val Val Gly Ala Ala Ile Trp Ala Ser Ser Trp Ala Glu Ile Ser
            195                 200                 205

tgc tgg atg tgg acc ggc gag cgg cag tcg acg cgg atg cgg atc cgg     672
Cys Trp Met Trp Thr Gly Glu Arg Gln Ser Thr Arg Met Arg Ile Arg
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            210                    215                    220

tac ctg gac gcg gcg ctg cgg cag gac gtg tcc ttc ttc gac acc gac    720
Tyr Leu Asp Ala Ala Leu Arg Gln Asp Val Ser Phe Phe Asp Thr Asp
225                 230                 235                 240

gtg cgc acc tcg gac gtc atc tac gcc atc aac gcg gac gcc gtg gtg    768
Val Arg Thr Ser Asp Val Ile Tyr Ala Ile Asn Ala Asp Ala Val Val
                    245                 250                 255

ggt gca gga cgc cat cag cga gaa gct ggg caa cct cat cca cta cat    816
Gly Ala Gly Arg His Gln Arg Glu Ala Gly Gln Pro His Pro Leu His
                260                 265                 270

ggc cac ctt cgt ggc ggg ctt cgt cgt ggg ctt cac cgc cgc ctg gca    864
Gly His Leu Arg Gly Gly Leu Arg Arg Gly Leu His Arg Arg Leu Ala
            275                 280                 285

gct ggc gct cgt cac gct cgc cgt cgt gcc gct cat cgc cgt cat cgg    912
Ala Gly Ala Arg His Ala Arg Arg Arg Ala Ala His Arg Arg His Arg
        290                 295                 300

ggg gct cag cgc cgc cgc gct cgc caa gct ctc ctc cag gag cca gga    960
Gly Ala Gln Arg Arg Arg Ala Arg Gln Ala Leu Leu Gln Glu Pro Gly
305                 310                 315                 320

cgc gct gtc ggg cgc cag cgg cat cgc gga gca ggc gct cgc gca gat   1008
Arg Ala Val Gly Arg Gln Arg His Arg Gly Ala Gly Ala Arg Ala Asp
                325                 330                 335

acg gat cgt gca ggc ctt cgt cgg cga gga gcg cga aat gcg ggc gta   1056
Thr Asp Arg Ala Gly Leu Arg Arg Arg Gly Ala Arg Asn Ala Gly Val
                340                 345                 350

ctc ggc ggc gtt ggc cgt cgc gca gaa gat cgg cta ccg cag cgg ctt   1104
Leu Gly Gly Val Gly Arg Arg Ala Glu Asp Arg Leu Pro Gln Arg Leu
            355                 360                 365

cgc caa ggg gct cgg cct cgg cgg cac cta ctt cac cgt ctt ctg ctg   1152
Arg Gln Gly Ala Arg Pro Arg Arg His Leu Leu His Arg Leu Leu Leu
        370                 375                 380

cta cgg cct cct gct ctg gta cgg cgg aca cct cgt ccg cgg aac cac   1200
Leu Arg Pro Pro Ala Leu Val Arg Arg Thr Pro Arg Pro Arg Asn His
385                 390                 395                 400

acc aac gga ggg ctc gcc atc gcc acc atg ttc tcc gtc atg atc ggc   1248
Thr Asn Gly Gly Leu Ala Ile Ala Thr Met Phe Ser Val Met Ile Gly
                405                 410                 415

ggg ctg gcc ctc ggg cag tcg gcg ccg agc atg gcc gcg ttc gcc aag   1296
Gly Leu Ala Leu Gly Gln Ser Ala Pro Ser Met Ala Ala Phe Ala Lys
            420                 425                 430

gcg cgc gtg gcg gcc gcc aag atc ttc cgc atc atc gac cac agg ccg   1344
Ala Arg Val Ala Ala Ala Lys Ile Phe Arg Ile Ile Asp His Arg Pro
            435                 440                 445
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ggc atc tcc tcg cgg gac ggc gag gac ggc ggc ggc gtg gag ctg gag    1392
Gly Ile Ser Ser Arg Asp Gly Glu Asp Gly Gly Gly Val Glu Leu Glu
    450             455             460

tcg gtg acg ggg cgg gtg gag atg agg ggc gtg gac ttc gcg tac ccg    1440
Ser Val Thr Gly Arg Val Glu Met Arg Gly Val Asp Phe Ala Tyr Pro
465             470             475             480

tcg cgg ccg gac gtc ccc atc ctg cgc ggc ttc tcg ctc agc gtg ccc    1488
Ser Arg Pro Asp Val Pro Ile Leu Arg Gly Phe Ser Leu Ser Val Pro
            485             490             495

gcc ggc aag acc atc gcg ctg gtg ggc agc tcc ggc tcc ggg aag agc    1536
Ala Gly Lys Thr Ile Ala Leu Val Gly Ser Ser Gly Ser Gly Lys Ser
            500             505             510

acg gtg gtg tcg ctc ctc gag agg ttc tac gac ccc agc gca ggg caa    1584
Thr Val Val Ser Leu Leu Glu Arg Phe Tyr Asp Pro Ser Ala Gly Gln
            515             520             525

atc ttg ctg gac ggg cat gat ctc aag tcg ctg aag ctc cgg tgg ctc    1632
Ile Leu Leu Asp Gly His Asp Leu Lys Ser Leu Lys Leu Arg Trp Leu
    530             535             540

cgg cag cag att ggt ctg gtg agc cag gag ccg acg ctg ttc gcg acg    1680
Arg Gln Gln Ile Gly Leu Val Ser Gln Glu Pro Thr Leu Phe Ala Thr
545             550             555             560

agc atc aag gag aac ctg ctg ctg ggg cgg gac agt cag agt gcg acg    1728
Ser Ile Lys Glu Asn Leu Leu Leu Gly Arg Asp Ser Gln Ser Ala Thr
            565             570             575

cag gcc gag atg gag gag gcc gcc agg gtg gcc aac gcg cac tcc ttc    1776
Gln Ala Glu Met Glu Glu Ala Ala Arg Val Ala Asn Ala His Ser Phe
            580             585             590

atc gtc aag ctc ccc gac ggc tac gac acg cag gtt ggg gag cgc ggc    1824
Ile Val Lys Leu Pro Asp Gly Tyr Asp Thr Gln Val Gly Glu Arg Gly
            595             600             605

ctg cag ctc tcc ggt ggg cag aag cag cgc atc gcc atc gcc cgc gcc    1872
Leu Gln Leu Ser Gly Gly Gln Lys Gln Arg Ile Ala Ile Ala Arg Ala
    610             615             620

atg ctc aag aac ccc gcc atc ctg ctg ctg gac gag gcc acc agc gcg    1920
Met Leu Lys Asn Pro Ala Ile Leu Leu Leu Asp Glu Ala Thr Ser Ala
625             630             635             640

ctg gac tcc gag tct gag aag ctc gtg cag gag gcg ctg gac cgc ttc    1968
Leu Asp Ser Glu Ser Glu Lys Leu Val Gln Glu Ala Leu Asp Arg Phe
            645             650             655

atg atc ggg cgc acc acc ctg gtg atc gcg cac agg atg tcc acc atc    2016
Met Ile Gly Arg Thr Thr Leu Val Ile Ala His Arg Met Ser Thr Ile
            660             665             670
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cgc aag gcc gac gtg gtg gcc gtg ctg cag ggc ggc ccc gtc tcc gag    2064
Arg Lys Ala Asp Val Val Ala Val Leu Gln Gly Gly Pro Val Ser Glu
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atg ggc gcg cac gac gag ttg atg gcc aag ggc gag aac ggc act tac    2112
Met Gly Ala His Asp Glu Leu Met Ala Lys Gly Glu Asn Gly Thr Tyr
        690             695             700

gcc aag ttc atc cgc atg cag gag cag gcg cac gag gcg gcg ttc gtc    2160
Ala Lys Phe Ile Arg Met Gln Glu Gln Ala His Glu Ala Ala Phe Val
705             710             715             720

aac gcc cgc cgc agc agc gcc agg ccc tcc agc gcc cgc aac tcc gtc    2208
Asn Ala Arg Arg Ser Ser Ala Arg Pro Ser Ser Ala Arg Asn Ser Val
            725             730             735

agc tcg ccc atc atg acg cgc aac tcc tcc tac ggc cgc tcc cca tac    2256
Ser Ser Pro Ile Met Thr Arg Asn Ser Ser Tyr Gly Arg Ser Pro Tyr
            740             745             750

tcc cgc cgc ctc tcc gac ttc tcc acc tcc gac ttc acc ctc tcc atc    2304
Ser Arg Arg Leu Ser Asp Phe Ser Thr Ser Asp Phe Thr Leu Ser Ile
            755             760             765

cac gac ccg cac cac cac cac cgg acg atg gcc gac aag cag ctc gcg    2352
His Asp Pro His His His His Arg Thr Met Ala Asp Lys Gln Leu Ala
        770             775             780

ttc cgc gcc ggc gcc agc tcc ttc ctc cgc ctc gcc agg atg aac tcg    2400
Phe Arg Ala Gly Ala Ser Ser Phe Leu Arg Leu Ala Arg Met Asn Ser
785             790             795             800

ccc gag tgg gcc tac gcg ctc gtc ggc tcc ctg ggc tcc atg gtc tgc    2448
Pro Glu Trp Ala Tyr Ala Leu Val Gly Ser Leu Gly Ser Met Val Cys
            805             810             815

ggc tcc ttc agc gcc atc ttc gcc tac atc ctc agc gcc gtg ctc agc    2496
Gly Ser Phe Ser Ala Ile Phe Ala Tyr Ile Leu Ser Ala Val Leu Ser
            820             825             830

gtc tac tac gcg ccg gac cct cgc tac atg aag cgc gag atc gcc aag    2544
Val Tyr Tyr Ala Pro Asp Pro Arg Tyr Met Lys Arg Glu Ile Ala Lys
            835             840             845

tac tgc tac ctg ctc atc ggc atg tcc tcc gcg gcg ctg ctg ttc aac    2592
Tyr Cys Tyr Leu Leu Ile Gly Met Ser Ser Ala Ala Leu Leu Phe Asn
        850             855             860

acg gtg cag cac gtg ttc tgg gac acg gtc ggc gag aac ctc acg aag    2640
Thr Val Gln His Val Phe Trp Asp Thr Val Gly Glu Asn Leu Thr Lys
865             870             875             880

cgt gtg cgc gag aag atg ttc gcc gcc gtg ctc cgc aac gag atc gcc    2688
Arg Val Arg Glu Lys Met Phe Ala Ala Val Leu Arg Asn Glu Ile Ala
            885             890             895

tgg ttc gac gcc gac gag aac gcc agc gcg cgc gtc gcc gcc agg ctc    2736
Trp Phe Asp Ala Asp Glu Asn Ala Ser Ala Arg Val Ala Ala Arg Leu
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Trp Phe Asp Ala Asp Glu Asn Ala Ser Ala Arg Val Ala Ala Arg Leu
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gcg ctc gac gcc cag aac gtg cgc tcc gcc atc ggg gac cgt atc tcc   2784
Ala Leu Asp Ala Gln Asn Val Arg Ser Ala Ile Gly Asp Arg Ile Ser
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gtc atc gtc cag aac tcg gcg ctc atg ctc gtc gcc tgc acc gcg ggc   2832
Val Ile Val Gln Asn Ser Ala Leu Met Leu Val Ala Cys Thr Ala Gly
        930               935               940

ttc gtc ctc cag tgg cgc ctc gcg ctc gtg ctc ctc gcc gtc ttc ccg   2880
Phe Val Leu Gln Trp Arg Leu Ala Leu Val Leu Leu Ala Val Phe Pro
945               950               ·955               960

ctc gtc gtg gcc gcc acc gtg ctg cag aag atg ttc atg aag ggc ttc   2928
Leu Val Val Ala Ala Thr Val Leu Gln Lys Met Phe Met Lys Gly Phe
                965               970               975

tcg ggg gac ctg gag gcc gcg cac gcc agg gcc acg cag atc gcg ggc   2976
Ser Gly Asp Leu Glu Ala Ala His Ala Arg Ala Thr Gln Ile Ala Gly
                980               985               990

gag gcc gtg gcc aac ctg cgc acc gtg gcc gcg ttc aac gcg gag cgc   3024
Glu Ala Val Ala Asn Leu Arg Thr Val Ala Ala Phe Asn Ala Glu Arg
        995               1000               1005

aag atc acg ggg ctg ttc gag gcc aac ctg cgc ggc ccg ctc cgg cgc   3072
Lys Ile Thr Gly Leu Phe Glu Ala Asn Leu Arg Gly Pro Leu Arg Arg
    1010               1015               1020

tgc ttc tgg aag ggg cag atc gcc ggc agc ggc tac ggc gtg gcg cag   3120
Cys Phe Trp Lys Gly Gln Ile Ala Gly Ser Gly Tyr Gly Val Ala Gln
1025               1030               1035               1040

ttc ctg ctg tac gcg tcc tac gcg ctg ggg ctg tgg tac gcg gcg tgg   3168
Phe Leu Leu Tyr Ala Ser Tyr Ala Leu Gly Leu Trp Tyr Ala Ala Trp
                1045               1050               1055

ctg gtg aag cac ggc gtg tcc gac ttc tcg cgc acc atc cgc gtg ttc   3216
Leu Val Lys His Gly Val Ser Asp Phe Ser Arg Thr Ile Arg Val Phe
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atg gtg ctg atg gtg tcc gcc aac ggc gcc gcc gag acg ctg acg ctg   3264
Met Val Leu Met Val Ser Ala Asn Gly Ala Ala Glu Thr Leu Thr Leu
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gcg ccg gac ttt gtc aag ggc ggg cgc gcg atg cgg tcc gtg ttc gag   3312
Ala Pro Asp Phe Val Lys Gly Gly Arg Ala Met Arg Ser Val Phe Glu
    1090               1095               1100

acc atc gac cgg aaa acg gag gtg gag ccc gac gac gtg gac gcg gcg   3360
Thr Ile Asp Arg Lys Thr Glu Val Glu Pro Asp Asp Val Asp Ala Ala
1105               1110               1115               1120

ccg gtg ccg gag cgg ccc aag ggc gag gtg gag ctg aag cac gtg gac   3408
Pro Val Pro Glu Arg Pro Lys Gly Glu Val Glu Leu Lys His Val Asp
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ctc cgg gcg cgc gcc ggg aag acg ctg gcg ctg gtg ggt ccg agc ggg    3504
Leu Arg Ala Arg Ala Gly Lys Thr Leu Ala Leu Val Gly Pro Ser Gly
        1155                1160                1165

tgc ggc aag agc tcg gtg ctg gcg ctg gtg cag cgg ttc tac gag ccc    3552
Cys Gly Lys Ser Ser Val Leu Ala Leu Val Gln Arg Phe Tyr Glu Pro
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acg tcc ggg cgc gtg ctc ctg gac ggc aag gac gtg cgc aag tac aac    3600
Thr Ser Gly Arg Val Leu Leu Asp Gly Lys Asp Val Arg Lys Tyr Asn
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ctg cgg gcg ctg cgg cgc gtg gtg gcg gtg gcg ccg cag gag ccg ttc    3648
Leu Arg Ala Leu Arg Arg Val Val Ala Val Ala Pro Gln Glu Pro Phe
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ctg ttc gcg gcg agc atc cac gac aac atc gcg tac ggg cgc gag ggc    3696
Leu Phe Ala Ala Ser Ile His Asp Asn Ile Ala Tyr Gly Arg Glu Gly
            1220                1225                1230

gcg acg gag gcg gag gtg gtg gag gcg gcg acg cag gcg aac gcg cac    3744
Ala Thr Glu Ala Glu Val Val Glu Ala Ala Thr Gln Ala Asn Ala His
        1235                1240                1245

cgg ttc atc gcg gcg ctg ccg gag ggc tac ggg acg cag gtg ggc gag    3792
Arg Phe Ile Ala Ala Leu Pro Glu Gly Tyr Gly Thr Gln Val Gly Glu
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cgc ggg gtg cag ctg tcg ggc ggg cag cgg cag cgg atc gcg atc gcg    3840
Arg Gly Val Gln Leu Ser Gly Gly Gln Arg Gln Arg Ile Ala Ile Ala
1265                1270                1275                1280

cgc gcg ctg gtg aag cag gcg gcc atc gtg ctg ctg gac gag gcg acc    3888
Arg Ala Leu Val Lys Gln Ala Ala Ile Val Leu Leu Asp Glu Ala Thr
            1285                1290                1295

agc gcg ctg gac gcc gag tcg gag cgg tgc gtg cag gag gcg ctg gag    3936
Ser Ala Leu Asp Ala Glu Ser Glu Arg Cys Val Gln Glu Ala Leu Glu
            1300                1305                1310

cgc gcg ggg tcc ggg cgc acc acc atc gtg gtg gcg cac cgg ctg gcc    3984
Arg Ala Gly Ser Gly Arg Thr Thr Ile Val Val Ala His Arg Leu Ala
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acg gtg cgc ggc gcg cac acc atc gcg gtc atc gac gac ggc aag gtg    4032
Thr Val Arg Gly Ala His Thr Ile Ala Val Ile Asp Asp Gly Lys Val
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gcg gag cag ggg tcg cac tcg cac ctg ctc aag cac cat ccc gac ggg    4080
Ala Glu Gln Gly Ser His Ser His Leu Leu Lys His His Pro Asp Gly
1345                1350                1355                1360
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tgc tac gcg cgg atg ctg cag ctg cag cgg ctg acg ggc ggg tgc cgc    4128
Cys Tyr Ala Arg Met Leu Gln Leu Gln Arg Leu Thr Gly Gly Cys Arg
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gcc cgg gcc gcc gcc gtc gtc gtc caa cgg ggc cgc cgc gta gga tgg    4176
Ala Arg Ala Ala Ala Val Val Val Gln Arg Gly Arg Arg Val Gly Trp
            1380                1385                1390

atg gat gga tca tgg atg agt ttg gtt cct tgataaa                    4213
Met Asp Gly Ser Trp Met Ser Leu Val Pro
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            35                  40                  45

Phe His Leu Ala Ala Gly His Gln Pro Glu Ala Ala Ala Glu Gln Pro
        50                  55                  60

Thr Thr Leu Pro Ala Ala Arg Arg Thr Ser Asp Thr Ser Thr Ala Ala
 65                  70                  75                  80

Gly Ala Ala Pro Pro Ser Pro Ser Pro Pro Pro Pro Ala Pro Leu
                85                  90                  95

Glu Met Asp Gln Pro Pro Asn Ala Lys Pro Ala Ser Ser Ser Ala Ala
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Ala Ala Gly Ala Asn Asp Asn Lys Lys Pro Thr Pro Pro Ala Ala Leu
            115                 120                 125

Arg Asp Leu Phe Arg Phe Ala Asp Gly Leu Asp Cys Ala Leu Met Leu
        130                 135                 140

Val Gly Thr Leu Gly Ala Leu Val His Gly Cys Ser Leu Pro Val Phe
145                 150                 155                 160

Leu Arg Phe Phe Ala Asp Leu Val Asp Ser Phe Gly Ser His Ala Asn
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Asp Pro Asp Thr Met Val Arg Leu Val Val Lys Tyr Ala Phe Tyr Phe
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Leu Val Val Gly Ala Ala Ile Trp Ala Ser Ser Trp Ala Glu Ile Ser
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                195                      200                      205
Cys Trp Met Trp Thr Gly Glu Arg Gln Ser Thr Arg Met Arg Ile Arg
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Tyr Leu Asp Ala Ala Leu Arg Gln Asp Val Ser Phe Phe Asp Thr Asp
225                 230                 235                 240

Val Arg Thr Ser Asp Val Ile Tyr Ala Ile Asn Ala Asp Ala Val Val
                245                 250                 255

Gly Ala Gly Arg His Gln Arg Glu Ala Gly Gln Pro His Pro Leu His
            260                 265                 270

Gly His Leu Arg Gly Gly Leu Arg Arg Gly Leu His Arg Arg Leu Ala
            275                 280                 285              .

Ala Gly Ala Arg His Ala Arg Arg Arg Ala Ala His Arg Arg His Arg
    290                 295                 300

Gly Ala Gln Arg Arg Arg Ala Arg Gln Ala Leu Leu Gln Glu Pro Gly
305                 310                 315                 320

Arg Ala Val Gly Arg Gln Arg His Arg Gly Ala Gly Ala Arg Ala Asp
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Thr Asp Arg Ala Gly Leu Arg Arg Arg Gly Ala Arg Asn Ala Gly Val
            340                 345                 350

Leu Gly Gly Val Gly Arg Arg Ala Glu Asp Arg Leu Pro Gln Arg Leu
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Arg Gln Gly Ala Arg Pro Arg Arg His Leu Leu His Arg Leu Leu Leu
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Leu Arg Pro Pro Ala Leu Val Arg Arg Thr Pro Arg Pro Arg Asn His
385                 390                 395                 400

Thr Asn Gly Gly Leu Ala Ile Ala Thr Met Phe Ser Val Met Ile Gly
 .              405                 410                 415

Gly Leu Ala Leu Gly Gln Ser Ala Pro Ser Met Ala Ala Phe Ala Lys
            420                 425                 430

Ala Arg Val Ala Ala Ala Lys Ile Phe Arg Ile Ile Asp His Arg Pro
            435                 440                 445

Gly Ile Ser Ser Arg Asp Gly Glu Asp Gly Gly Gly Val Glu Leu Glu
    450                 455                 460

Ser Val Thr Gly Arg Val Glu Met Arg Gly Val Asp Phe Ala Tyr Pro
465                 470                 475                 480

Ser Arg Pro Asp Val Pro Ile Leu Arg Gly Phe Ser Leu Ser Val Pro
                485                 490                 495

Ala Gly Lys Thr Ile Ala Leu Val Gly Ser Ser Gly Ser Gly Lys Ser
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              500                    505                    510

Thr Val Val Ser Leu Leu Glu Arg Phe Tyr Asp Pro Ser Ala Gly Gln
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Ile Leu Leu Asp Gly His Asp Leu Lys Ser Leu Lys Leu Arg Trp Leu
        530                    535                    540

Arg Gln Gln Ile Gly Leu Val Ser Gln Glu Pro Thr Leu Phe Ala Thr
545                    550                    555                    560

Ser Ile Lys Glu Asn Leu Leu Leu Gly Arg Asp Ser Gln Ser Ala Thr
                565                    570                    575

Gln Ala Glu Met Glu Glu Ala Ala Arg Val Ala Asn Ala His Ser Phe
                580                    585                    590

Ile Val Lys Leu Pro Asp Gly Tyr Asp Thr Gln Val Gly Glu Arg Gly
        595                    600                    605

Leu Gln Leu Ser Gly Gly Gln Lys Gln Arg Ile Ala Ile Ala Arg Ala
        610                    615                    620

Met Leu Lys Asn Pro Ala Ile Leu Leu Leu Asp Glu Ala Thr Ser Ala
625                    630                    635                    640

Leu Asp Ser Glu Ser Glu Lys Leu Val Gln Glu Ala Leu Asp Arg Phe
                645                    650                    655

Met Ile Gly Arg Thr Thr Leu Val Ile Ala His Arg Met Ser Thr Ile
                660                    665                    670

Arg Lys Ala Asp Val Val Ala Val Leu Gln Gly Gly Pro Val Ser Glu
   .            675                    680                    685

Met Gly Ala His Asp Glu Leu Met Ala Lys Gly Glu Asn Gly Thr Tyr
        690                    695                    700

Ala Lys Phe Ile Arg Met Gln Glu Gln Ala His Glu Ala Ala Phe Val
705                    710                    715                    720

Asn Ala Arg Arg Ser Ser Ala Arg Pro Ser Ser Ala Arg Asn Ser Val
                725                    730                    735

Ser Ser Pro Ile Met Thr Arg Asn Ser Ser Tyr Gly Arg Ser Pro Tyr
                740                    745                    750

Ser Arg Arg Leu Ser Asp Phe Ser Thr Ser Asp Phe Thr Leu Ser Ile
                755                    760                    765

His Asp Pro His His His His Arg Thr Met Ala Asp Lys Gln Leu Ala
        770                    775                    780

Phe Arg Ala Gly Ala Ser Ser Phe Leu Arg Leu Ala Arg Met Asn Ser
785                    790                    795                    800

Pro Glu Trp Ala Tyr Ala Leu Val Gly Ser Leu Gly Ser Met Val Cys
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                   805                         810                         815

Gly Ser Phe Ser Ala Ile Phe Ala Tyr Ile Leu Ser Ala Val Leu Ser
          820                     825                     830

Val Tyr Tyr Ala Pro Asp Pro Arg Tyr Met Lys Arg Glu Ile Ala Lys
          835                     840                     845

Tyr Cys Tyr Leu Leu Ile Gly Met Ser Ser Ala Ala Leu Leu Phe Asn
    850                     855                     860

Thr Val Gln His Val Phe Trp Asp Thr Val Gly Glu Asn Leu Thr Lys
865                     870                     875                     880

Arg Val Arg Glu Lys Met Phe Ala Ala Val Leu Arg Asn Glu Ile Ala
              885                     890                     895

Trp Phe Asp Ala Asp Glu Asn Ala Ser Ala Arg Val Ala Ala Arg Leu
          900                     905                     910

Ala Leu Asp Ala Gln Asn Val Arg Ser Ala Ile Gly Asp Arg Ile Ser
          915                     920                     925

Val Ile Val Gln Asn Ser Ala Leu Met Leu Val Ala Cys Thr Ala Gly
    930                     935                     940

Phe Val Leu Gln Trp Arg Leu Ala Leu Val Leu Leu Ala Val Phe Pro
945                     950                     955                     960

Leu Val Val Ala Ala Thr Val Leu Gln Lys Met Phe Met Lys Gly Phe
              965                     970                     975

Ser Gly Asp Leu Glu Ala Ala His Ala Arg Ala Thr Gln Ile Ala Gly
          980                     985                     990

Glu Ala Val Ala Asn Leu Arg Thr Val Ala Ala Phe Asn Ala Glu Arg
          995                     1000                    1005

Lys Ile Thr Gly Leu Phe Glu Ala Asn Leu Arg Gly Pro Leu Arg Arg
    1010                    1015                    1020

Cys Phe Trp Lys Gly Gln Ile Ala Gly Ser Gly Tyr Gly Val Ala Gln
1025                    1030                    1035                    1040

Phe Leu Leu Tyr Ala Ser Tyr Ala Leu Gly Leu Trp Tyr Ala Ala Trp
          1045                    1050                    1055

Leu Val Lys His Gly Val Ser Asp Phe Ser Arg Thr Ile Arg Val Phe
              1060                    1065                    1070

Met Val Leu Met Val Ser Ala Asn Gly Ala Ala Glu Thr Leu Thr Leu
    1075                    1080                    1085

Ala Pro Asp Phe Val Lys Gly Gly Arg Ala Met Arg Ser Val Phe Glu
    1090                    1095                    1100

Thr Ile Asp Arg Lys Thr Glu Val Glu Pro Asp Asp Val Asp Ala Ala
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1105                  1110                    1115                      1120
Pro Val Pro Glu Arg Pro Lys Gly Glu Val Glu Leu Lys His Val Asp
              1125                1130                1135

Phe Ser Tyr Pro Ser Arg Pro Asp Ile Gln Val Phe Arg Asp Leu Ser
          1140                1145                1150

Leu Arg Ala Arg Ala Gly Lys Thr Leu Ala Leu Val Gly Pro Ser Gly
      1155                1160                1165

Cys Gly Lys Ser Ser Val Leu Ala Leu Val Gln Arg Phe Tyr Glu Pro
   1170                1175                1180

Thr Ser Gly Arg Val Leu Leu Asp Gly Lys Asp Val Arg Lys Tyr Asn
1185                1190                1195                1200

Leu Arg Ala Leu Arg Arg Val Val Ala Val Ala Pro Gln Glu Pro Phe
              1205                1210                1215

Leu Phe Ala Ala Ser Ile His Asp Asn Ile Ala Tyr Gly Arg Glu Gly
          1220                1225                1230

Ala Thr Glu Ala Glu Val Val Glu Ala Ala Thr Gln Ala Asn Ala His
      1235                1240                1245

Arg Phe Ile Ala Ala Leu Pro Glu Gly Tyr Gly Thr Gln Val Gly Glu
   1250                1255                1260

Arg Gly Val Gln Leu Ser Gly Gly Gln Arg Gln Arg Ile Ala Ile Ala
1265                1270                1275                1280

Arg Ala Leu Val Lys Gln Ala Ala Ile Val Leu Leu Asp Glu Ala Thr
              1285                1290                1295

Ser Ala Leu Asp Ala Glu Ser Glu Arg Cys Val Gln Glu Ala Leu Glu
          1300                1305                1310

Arg Ala Gly Ser Gly Arg Thr Thr Ile Val Val Ala His Arg Leu Ala
      1315                1320                1325

Thr Val Arg Gly Ala His Thr Ile Ala Val Ile Asp Asp Gly Lys Val
   1330                1335                1340

Ala Glu Gln Gly Ser His Ser His Leu Leu Lys His His Pro Asp Gly
1345                1350                1355                1360

Cys Tyr Ala Arg Met Leu Gln Leu Gln Arg Leu Thr Gly Gly Cys Arg
              1365                1370                1375

Ala Arg Ala Ala Ala Val Val Val Gln Arg Gly Arg Arg Val Gly Trp
          1380                1385                1390

Met Asp Gly Ser Trp Met Ser Leu Val Pro
      1395                1400
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